REMARKS

The Examiner has rejected claims 1-20 under 35 U.S.C. § 103(a) of which claims 1 and 18 are the only independent claims. Claims 1, 3, and 8 stand rejected as being unpatentable over Usui U.S. Patent No. 5,513,765 (*Usui*) in view of Tanaka et al., U.S. Patent No. 6,210,539 (*Tanaka*). Claims 2, 5, 9 and 10 stand rejected as being unpatentable over *Usui* and *Tanaka* in view of Moslehi et al., U.S. Patent No. 6,471,830 (*Moslehi*). Claim 4 stands rejected as being unpatentable over *Usui* and *Tanaka* in view of Roderick, U.S. Patent No. 6,353,206 (*Roderick*). Claim 6 stands rejected as being unpatentable over *Usui* and *Tanaka* in view of *Moslehi* and Denda et al., U.S. Patent No. 6,440,260 (*Denda*). Claim 7 stands rejected as being unpatentable over *Usui* and *Tanaka* in view Dible et al., U.S. Patent No. 6,042,686 (*Dible*). Claim 11 stands rejected as being unpatentable over *Usui* and *Tanaka* in view of *Denda* and Liu et al., U.S. Patent Application Publication No. 2002/0027205 (*Liu*). Claims 12 and 15-17 stand rejected as being unpatentable over *Usui* and *Tanaka* in view of *Denda* and Pu et al., U.S. Patent No. 6,825,618 (*Pu*). Claim 13 stands rejected as being unpatentable over *Usui* and *Tanaka* in view of *Denda* and Hanawa, U.S. Patent No. 6,027,601 (*Hanawa*). Claim 14 stands rejected as being unpatentable over *Usui* and *Tanaka* in view of *Denda*, *Hanawa*, and *Moslehi*. Claim 18 stands rejected as being unpatentable over *Usui*, *Tanaka* and *Pu*. Claims 19 and 20 stand rejected as being unpatentable over *Usui*, *Tanaka* and *Pu* in view of *Moslehi*. Claims 1, 18 and 20 have been amended, claims 2 and 19 are canceled, and claim 26 is new. The following remarks are respectfully submitted.

Rejections based on *Usui* in view of *Tanaka*

The Examiner's position with regard to Claim 1 is that *Usui* teaches all of the elements of claim 1 except for a "peripheral ionization source surrounding the substrate support on the periphery of the substrate support, the substrate support and the peripheral ionization source forming a common planar surface having a substrate support at its center." The Examiner further

states that *Tanaka* teaches a peripheral ionization source, a coil, that surrounds and is mounted on the periphery of the substrate support. The Examiner concludes that one of ordinary skill in the art at the time of the invention would use the coil in *Tanaka* in the apparatus of *Usui*. Applicant disagrees with the Examiner for the following reasons.

First, *Usui* is an etching apparatus where *Tanaka* is a deposition apparatus which is evidenced by the disclosures and claims of each of the references. U.S. Patent No. 6,755,945 ('945) discusses the differences between a deposition process and an etch process. The '945 patent discusses the fact that a relatively high pressure is used during a deposition process, at least for present day, ionized physical vapor deposition systems (IPVD) that use high density inductively coupled plasma (ICP), which is the case with the *Tanaka* reference. Deposition with a high density plasma is typically at pressures of 20 or 30 mTorr or above, sometimes as high as 60-150 mTorr. Etch pressure, on the other hand, is below 10 mTorr, usually around 1 mTorr. This difference is necessary because etching uses high energy gas ions that should move in straight lines for some distance without colliding with gas atoms, while IPVD uses metal atoms that collide with charged particles in a plasma to form metal ions, which are in turn are moved at low energy across a narrow plasma sheath to coat the substrate.

More particularly, "high density plasma" means a high ion fraction, not necessarily high pressure, so high density plasma in *Usui* would still be at relatively low pressure when compared to *Tanaka's* deposition pressure. At low pressures, gas ions still move in lines toward the substrate from the points at which they are created, with few collisions, a field configuration desirable for etching. When ICP is used for deposition, as *Tanaka* does in Ionized PVD, a high pressure IC plasma is produced, in which a mixture of neutral and charged particles are more closely spaced in the plasma region, bounded by a surface, and at a fairly uniform potential. A plasma sheath typically surrounds the plasma in which the potential drops from a

common potential at the plasma boundary to that of the surrounding surfaces, including the negative bias potential of the substrate. Metal is sputtered from a target by a separate DC plasma energy source and enters the dense plasma, which is at a high enough pressure to insure that the metal atoms will collide with charged particles. This causes the metal to become ionized and remain in the plasma, with only those metal ions at the plasma boundary being accelerated across the plasma sheath onto the substrate. The voltage drop across the plasma sheath is typically about 20 volts, so the metal ions arrive at the substrate with relatively low energy to coat the substrate.

To etch, gas ions need more energy and should move in relatively straight lines over longer distances, so lower pressure is needed. The electric fields shown in *Tanaka* are not suitable for an etching process. Putting the *Tanaka* coil inside of the *Usui* chamber would create an undesirable field for *Usui*. For this reason, one would not combine *Tanaka's* deposition chamber architecture with *Usui's* etch chamber architecture. "If the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." In re Gordon, 733 F.2d 900 (Fed. Cir. 1984); MPEP § 2143(V).

The '945 patent is unique in that it seeks to both deposit and etch in the same chamber. To sequentially deposit and etch, the pressure of the chamber is changed from a relatively high pressure to deposit, to a relatively low pressure to etch. Neither *Usui* nor *Tanaka* teach or suggest mixing deposition and etching. Accordingly, there would be no motivation to replace the coil of *Usui*, which is used at low pressures for etching with the coil of *Tanaka* which is used at high pressures for deposition.

Additionally, *Usui* discloses a vacuum chamber with an inductive-coupling coil wound around the outside of the chamber. (FIGS. 1-3 and col. 3 ll. 50-51). According to *Usui*,

the coil is used to generate an inductively coupled plasma in the vacuum chamber. The coil is connected in series with a pair of planar electrodes that generate a capacitively-coupled plasma. As stated in *Usui*, "In this plasma generating process, an electric field is generated along the central axis of the inductive-coupling coil, so that distribution of the inductively-coupled plasma may be uniform and directions of plasma streams may be adjusted to one desired direction." Also due to the electric and magnetic fields having the same operating cycle from the series combination of the coil and electrodes, the energy streams are always oriented in the same directions supplying a stable plasma.

Tanaka discloses a vacuum chamber with a plasma generating coil, inside the vacuum chamber. (FIG. 1). According to *Tanaka*, the placement of the coil, with at least the lower most turn of the coil located close to or below the wafer, creates a plasma that is located substantially above the wafer and is uniform across the wafer. The coil arrangement in *Tanaka* is supposed to solve the problem of a non-uniform inductively-coupled plasma, which is an alternative to, and would eliminate the need for, the capacitively coupled plasma that *Usui* provides by using the electrodes to create the plasma.

Substituting the coil from *Tanaka* for the coil in *Usui* would leave the coil outside of the chamber. Neither reference teaches or suggests a desire to move the coil from the outside of the chamber to the inside of the chamber. In addition, using the coil from *Tanaka* in *Usui* would eliminate the need for the series connection to the capacitively coupled plasma. *Usui* would have no reason to substitute *Tanaka*'s coil, which is intended by *Tanaka* to provide the plasma uniformity function already provided by *Usui*'s capacitive coupling electrodes.

Further, relocating the coil from outside the chamber to inside the chamber places a coil in the vacuum and in contact with the plasma. Such coil placements can drastically change

the characteristics of the behavior of the plasma as well as introduce additional concerns that result from the loss of isolation between the plasma and the coil. Those skilled in the art would regard internal and external coil or electrode placements as distinct and incompatible approaches to plasma processor design. Applicant has added a new and narrower independent claim, claim 26, to make the differences more apparent.

Accordingly, there would be no motivation to replace the coil of *Usui* with the coil of *Tanaka*, which eliminates the need for a portion of the apparatus in *Usui*, and provides a redundant function while still leaving the coil outside of the chamber.

When the motivation to combine the teachings of the references is not immediately apparent, it is the duty of the examiner to explain why the combination of the teachings is proper. *Ex parte Skinner*, 2 USPQ2d 1788 (Bd. Pat. App. & Inter. 1986); MPEP § 2142. The evidence provides no explanation of why the combination is proper, the rejection merely states that the configuration of *Usui* with the *Tanaka* coil renders claim 1 obvious. Therefore, Applicant submits that one of ordinary skill in the art would not have substituted the coil in *Usui* with the coil in *Tanaka* for the reasons detailed above and that there is no motivation to combine the references.

New claim 26 includes a more detailed recitation of structure for producing a planar device in a chamber that combines inductive and capacitive coupling. It recites that the peripheral ionization source is inside of the chamber along with a slotted Faraday shield that limits capacitive coupling. *Tanaka's* coil is exposed to the plasma and will inherently capacitively couple to the plasma. This capacitive coupling will introduce circumferential non-uniformities to the plasma because of the voltage drop along the coil conductor.

The references fail to teach the claimed combination of these features. For the reasons stated above, Applicant contends that claim 26 is patentable over the cited references. Furthermore, claims 1 and 18, as amended, are also patentable for the reasons stated above, over *Usui* in view of *Tanaka*, and accordingly the rejections for claims 1 and 18 should be withdrawn.

Claims 2 and 19 have been canceled, rendering their rejections moot. Because claims 3 through 17 depend from claim 1 and claim 20 depends from claim 18, their rejections are also based on the combination of *Usui* and *Tanaka*. Applicant contends that these claims are also patentable for at least the same reasons stated above. Therefore the rejections for claims 3 through 17 and 20 should be withdrawn.

Conclusion

Applicant has made a bona fide effort to respond to each and every requirement set forth in the Office Action. In view of the foregoing remarks given herein, Applicant respectfully believes this case is in condition for allowance and respectfully requests allowance of the pending claims. If the Examiner believes any detailed language of the claims requires further discussion, the Examiner is respectfully asked to telephone the undersigned attorney so that the matter may be promptly resolved. The Examiner's prompt attention to this matter is appreciated.

Applicant is of the opinion that no additional fee is due as a result of this Amendment. If any additional charges or credits are necessary to complete this communication, please apply them to Deposit Account No. 23-3000.

Respectfully submitted,

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